

Chapter 8: Proportions: In-class review

NAME: Kelly

1- You work as a statistician at a large company with thousands of employees. Your boss is worried about the percent of employees who are unhappy with their job.

a. You take a simple random sample of 500 employees and find that 88 of them are unhappy with their job. Estimate the true percent of employees unhappy with their job. Use 95% confidence.

$n=500$	<u>State</u>	<u>Check</u>
$X=88$	1) SRS	1) circled
95% conf.	2) $n\hat{p}$	2) $88 \neq 10$
$= 88/500$	$n(1-\hat{p}) \geq 10$	$412 \neq 10$
	3) $pop \geq 10 \cdot n$	3) $pop \neq 5000$

$$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = (0.14262, 0.20938)$$

We are 95% conf. that the true prop. of employees unhappy w/ their job is btw 0.14262 and 0.20938.

b. What sample size would be required to make the margin of error 0.07? (keep the 95% confidence, and use the same  $\hat{p}$ )

$$0.07 = 1.96 \sqrt{\frac{0.176(1-0.176)}{n}}$$

$$n = 114$$

c. A previous study concluded that 21% of employees were unhappy with their job. However the boss thinks that morale at the company has improved (*less* people are unhappy with their jobs). Use a 0.04 level of significance to test this claim.

Assump. checked above

$$H_0: p = 0.21$$

$$H_a: p < 0.21$$

$$Z = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}} = -1.8666$$

$$P(Z < -1.8666) = 0.03098$$

We reject  $H_0$  b/c  $p\text{-value} < \alpha = 0.04$ .  
We have suff. evid. that the true percent of people that are unhappy w/ their job is less than 21%. Morale has improved.

2- Your boss also wants to find out employees feelings on salary. Specifically, he wants to compare the feelings between management-level employees and regular employees. He thinks that management-level employees will be happier about their salary.

- a. To test his claim, you take a SRS of 110 management employees and find that 80 are happy with their salary. You then take a SRS of 240 regular employees and find that 146 are happy with their salary. Test the boss' claim at the 0.06 level of significance.

$$n_1 = 110$$

$$X_1 = 80$$

$$n_2 = 240$$

$$X_2 = 146$$

$$\alpha = 0.06$$

State	Check
1) 2 indep. SRS	1) stated
2) $n_1 \hat{p}_1$ $n_1(1-\hat{p}_1)$ $n_2 \hat{p}_2$ $n_2(1-\hat{p}_2) \geq 10$	2) 80 30 146 94
3) $pop_1 \geq 10 \cdot n_1$ $pop_2 \geq 10 \cdot n_2$	3) $pop_1 \geq 1100$ $pop_2 \geq 1460$

$$H_0: p_M = p_R$$

$$H_a: p_M > p_R$$

$$Z = \frac{\hat{p}_M - \hat{p}_R}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_M} + \frac{1}{n_R}\right)}} = 2.1597$$

$$P(Z > 2.1597) = 0.0154$$

We reject  $H_0$  b/c p-value  $< \alpha = 0.06$ .  
We have suff. evid. that the perc  
of managers happy w/ salary is greater

- b. Estimate the difference in the proportions of managerial and regular employees' happiness with their salaries. Use 99% confidence.

$$(\hat{p}_M - \hat{p}_R) \pm z^* \sqrt{\frac{\hat{p}_M(1-\hat{p}_M)}{n_M} + \frac{\hat{p}_R(1-\hat{p}_R)}{n_R}} = (-0.0173, 0.25514)$$

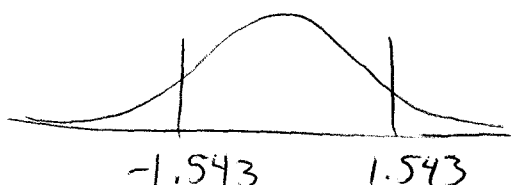
percent  
reg. emp  
happy w/sali

We are 99% confident that the difference btw. the prop. of managerial + reg. employees happy with their salaries is btw. -0.0173 and 0.25514. Since 0 is in the interval, there is no difference btw. the 2 prop.

3. I have a confidence interval that is  $16\% \pm 4\%$ . This interval is from an SRS of size 200. What is the level of confidence?

$$0.04 = z^* \sqrt{\frac{(0.16)(0.84)}{200}}$$

$$z^* = 1.543$$



$$\text{conf level} = 87.717\%$$